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Claims

1. A process for making a thin film ZnO/Cu(InGa)Se<sub>2</sub> solar cell without depositing a buffer layer and by Zn doping from a vapor phase, comprising:

5 a) depositing Cu(InGa)Se<sub>2</sub> layer on a metal back contact deposited on a glass substrate;

b) heating the Cu(InGa)Se<sub>2</sub> layer on said metal back contact on said glass substrate to a temperature range between about 100°C to about 250°C;

10 c) subjecting the heated layer of Cu(InGa)Se<sub>2</sub> to an evaporant species from a Zn compound; and

d) sputter depositing ZnO on the Zn compound evaporant species treated layer of Cu(InGa)Se<sub>2</sub>.

2. The process of claim 1 wherein said metal back contact is Mo.

15 3. The process of claim 2 wherein the zinc compound is selected from the group consisting of zinc acetate dehydrate, zinc chloride, zinc iodide, and zinc bromide.

4. The process of claim 3 wherein said zinc compound is zinc acetate dihydrate.

5. The process of claim 3 wherein in step c) the heated layer of Cu(InGa)Se<sub>2</sub> is subjected to said evaporant species from said Zn compound under a vacuum.

6. The process of claim 4 wherein the substrate temperature is about 100°C.

20 7. The process of claim 4 wherein the substrate temperature is about 150°C.

8. The process of claim 4 wherein the substrate temperature is about 200°C.

9. The process of claim 4 wherein the substrate temperature is between 200°C and 250°C.

10. The process of claim 6 wherein said acetic acid is used in an amount of about 25 50% by volume with water.

11. The process of claim 7 wherein said acetic acid is used in an amount of about 50% by volume with water.

12. The process of claim 8 wherein said acetic acid is used in an amount of about 50% by volume with water.

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13. The process of claim 9 wherein said acetic acid is used in an amount of about 50% by volume with water.

14. The process of claim 10 wherein, prior to sputter depositing ZnO in step d) an annealing step is performed at a temperature range from about 150°C to about 200°C.

5 15. The process of claim 11 wherein, prior to sputter depositing ZnO in step d) an annealing step is performed at a temperature range from about 150°C to about 200°C.

16. The process of claim 12 wherein, prior to sputter depositing ZnO in step d) an annealing step is performed at a temperature range from about 150°C to about 200°C.

10 17. The process of claim 13 wherein, prior to sputter depositing ZnO in step d) an annealing step is performed at a temperature range from about 150°C to about 200°C.

18. A thin film photovoltaic device comprising a first layer of p-type Cu(InGa)Se<sub>2</sub> semiconductor having an n-type second layer of an evaporant species from a Zn compound that has been etched with acetic acid and sputter deposited with ZnO.

15 19. The thin film photovoltaic device of claim 18 wherein the Zn compound is zinc acetate dihydrate.